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A Novel Spatial Filter Pinhole for High Energy Pulsed Lasers*

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Pinhole spatial filters are essential components in high energy pulsed laser systems. The long duration (20 ns) high energy pulses envisioned for future inertial confinement fusion drive systems, such as the proposed U.S. National Ignition Facility (NIF), are likely to lead to increased plasma generation and closure effects within the pinholes in the spatial filters. The design goal for the pinhole spatial filter in the four pass cavity of the Livermore Beamlet/NIF laser is to remove noise sources in the beam down to a 100 μrad divergence. It is uncertain whether this design requirement can be met with a conventional pinhole design. A new pinhole design proposed by one of us attempts to address these issues by incorporating features to reduce the rate of plasma generation. It consists of a conical surface designed to reject the high spatial frequency wings in the far field by a process of refraction and reflection at the surface thereby steering these components out of the collimating lens rather than absorbing them. The reduced absorption significantly reduces the rate of plasma generation. We have performed experiments and simulations to compare its performance with a conventional washer-type pinhole design. Initial experiments examining closure times with this design have verified its expected performance improvement relative to a conventional pinhole design.

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